

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of the claims in the application:

Listing of Claims:

1-38 (canceled)

39. (currently amended) A non-naturally occurring polynucleotide encoding a DNA-binding domain or an activation domain of a transcriptional activator and comprising a nucleotide sequence selected from the group consisting of:

- (a) the nucleotide sequence of SEQ ID NO:3;
- (b) nucleotide sequence of SEQ ID NO:4;
- (c) a nucleotide sequence which is at least 90% identical to the nucleic acid of (a) or (b) and which encodes a peptide that is capable of binding to an amino-terminal inactivation region of an ion channel protein; and
- (d) a nucleotide sequence which is degenerate as a result of the genetic code to a nucleic acid defined in (a) or (b) and which encodes a peptide that is capable of binding to an amino-terminal inactivation region of an ion channel protein.

40. (currently amended) A non-naturally occurring polynucleotide encoding a DNA-binding domain or an activation domain of a transcriptional activator and comprising a nucleotide sequence selected from the group consisting of:

- (a) the nucleotide sequence of SEQ ID NO:7;
- (b) nucleotide sequence of SEQ ID NO:8;
- (c) a nucleic acid molecule which is at least 80% identical to the nucleic acid of (a) or (b) and which encodes a peptide that is capable of binding to an intracellular receptor region of an α -subunit of a voltage-gated ion channel; and
- (d) a nucleic acid molecule which is degenerate as a result of the genetic code to a nucleic acid defined in (a) or (b) and which encodes a peptide that is capable of binding to an intracellular receptor region of an α -subunit of a voltage-gated ion channel.

41. (original) An expression vector comprising the polynucleotide of claim 39.

42. (original) An expression vector comprising the polynucleotide of claim 40.

43. (original) A host cell transfected or transformed with the expression vector of claim 41.

44. (original) A host cell transfected or transformed with the expression vector of claim 42.

45. (new) A non-naturally occurring polynucleotide encoding a fusion protein, wherein said fusion protein comprises:

an S4-S5 cytoplasmic loop of an ion channel; and
a DNA-binding or transcription activation domain of a transcriptional activator.

46. (new) The polynucleotide of claim 45, wherein said S4-S5 cytoplasmic loop is an S4-S5 cytoplasmic loop of a potassium channel α -subunit.

47. (new) The polynucleotide of claim 46, wherein said potassium channel is selected from the group consisting of Kv1.1, Kv1.2, Kv1.3, Kv1.4, Kv1.5, Kv1.6, and Kv3.4.

48. (new) The polynucleotide of claim 47, wherein said S4-S5 cytoplasmic loop comprises SEQ ID NO:1 or SEQ ID NO:2.

49. (new) The polynucleotide of claim 47, wherein said fusion protein consists essentially of said S4-S5 cytoplasmic loop and said DNA-binding or transcription activation domain.

50. (new) A non-naturally occurring polynucleotide encoding a fusion protein, wherein said fusion protein comprises:

an amino-terminal inactivation region of an ion channel; and

a DNA-binding or transcription activation domain of a transcriptional activator.

51. (new) The polynucleotide of claim 50, wherein said amino-terminal inactivation region is an amino-terminal inactivation region of a potassium channel α - or β -subunit.

52. (new) The polynucleotide of claim 51, wherein said potassium channel α - or β -subunit is selected from the group consisting of Kv 1, Kv 1.2, Kv31.3, Kv33, Kv3.4, and Kv1.4.

53. (new) The polynucleotide of claim 52, wherein said amino-terminal inactivation region comprises SEQ ID NO:5 or SEQ ID NO:6.

54. (new) The polynucleotide of claim 52, wherein said fusion protein consists essentially of said amino-terminal inactivation region and said DNA-binding or transcription activation domain.

55. (new) A host cell comprising:

a first polynucleotide according to claim 50; and

a second polynucleotide encoding a fusion protein which comprises:

(a) an S4-S5 cytoplasmic loop of an ion channel; and

(b) a DNA-binding domain if the first polynucleotide encodes the transcription activation domain of said transcriptional activator, or a transcription activation domain if the first polynucleotide encodes the DNA-binding domain of said transcriptional activator.

56. (new) A non-naturally occurring polynucleotide encoding a fusion protein, wherein said fusion protein comprises:

an S4-S5 cytoplasmic loop or an amino-terminal inactivation region of a potassium or sodium channel; and

a cell compartment localization domain or a first polypeptide selected from a peptide binding pair.

57. (new) The polynucleotide of claim 56, wherein said fusion protein comprises:
an S4-S5 cytoplasmic loop of a potassium channel selected from the group
consist of Kv1.1, Kv1.2, Kv1.3, Kv1.4, Kv1.5, Kv1.6, and Kv3.4; or
an amino-terminal inactivation region of a potassium channel selected from
the group consisting of Kv31, Kv31.2, Kv31.3, Kv33, Kv3.4, and Kv1.4.

58. (new) A host cell comprising the polynucleotide of claim 57, wherein said fusion
protein comprises:

SEQ ID NO:1 or SEQ ID NO:2; and
the first polypeptide selected from said peptide binding pair,
wherein said host cell comprises another polynucleotide which encodes a fusion protein
comprising:
SEQ ID NO:5 or SEQ ID NO:6; and
a second polypeptide selected from said peptide binding pair,
and wherein interaction between the first and second polypeptides is capable of activating a
signal transduction pathway in said host cell.